the request for a fifth representative. The Confederation of British Industry has requested that its representative Mr John Gilby, be renominated and is awaiting a reply.

The situation of the science and public interest representatives is, however, considerably less clear. They are directly appointed by the DES but there appears to be no set procedure governing these appointments beyond "usefulness to the group". Ravetz has certainly been useful, but he has also not shrunk from expressing his opinions, and he may have been seen by some close to GMAG to be 'rocking the boat'.

According to one DES spokesman, the public interest representatives are the ones most likely to change "because the scientific specialists are a small group to choose from", but he expects that the overall "mixture of representatives" will remain the same—except that possibly a lawyer will be included on GMAG for the first time. As to who at the DES is responsible for the changes on GMAG, several sources indicate that Shirley Williams, the Education Secretary, is taking a direct and personal interest in the new appointments. However, her advisers on GMAG remain in the shadows and do not appear to include GMAG's existing members.

All this might be unimportant if it were not symptomatic of how GMAG handles its external relations. And external relations are important to a body whose decisions can affect the competitiveness of British biotechnology industry overseas. In this context, it is obviously desirable to get GMAG's standards accepted and applied by other countries. Unfortunately GMAG does not appear to communicate effectively with foreign scientific organisations. There is a strong feeling among some European scientists that GMAG could provide greater leadership in Europe by revealing more details of its work. As Dr Ravetz argues: "in about a year an American GMAG could be established that would operate in public and be easily accessible to foreign scientists. If that happens, the British GMAG would probably be ignored rather than be viewed as a model for all the world".

A. J. McClelland

Difficulties at PETRA worry designers of Europe's next accelerator

PETRA, the world's biggest storage ring for colliding electrons with positrons, is not behaving quite as expected, writes **Konrad Guettler**

THE European Committee for Future Accelerators (ECFA) convened its technical panel on the design of LEP —Europe's proposal for a 70 to 100 GeV electron and positron storage ring —in Rome recently, only to hear that the machine of which much LEP design has been based (West Germany's 19 GeV PETRA) is encountering difficulties.

Although PETRA started up very smoothly, ahead of schedule, and soon achieved beams of long lifetime, its luminosity (which determines the rate at which experiments can be done) is at present a factor of 100 or so below design. The profound worry is that the scaling up of parameters from lower energy machines, such as the 10 GeV DORIS and SPEAR, to the very much higher energies of PETRA or LEP may in fact not be straightforward, or indeed possible at all. It is still early days for PETRA but a large investigation program on both the technical and the theoretical side has now been launched both at DESY and by ECFA.

Nicola Cabbibo, a particle theorist at Rome University, and CERN are directing the attempts at increasing theoretical understanding of the observed beam properties. The main effects are the following:

- the maximum beam-beam tune shift 'ΔQ' is much less than its design value. ΔQ is the major factor, apart from the stored particle current, determining the machine luminosity, ie the number of interactions that take place at an intersection in unit time. The tune shift is a measure of the non-linear transverse forces between colliding bunches. All the existing machines turned out to have the same limiting value; and this ΔQ had also been assumed for PETRA and for LEP.
- Fast beam instabilities occur at various stored currents and appear to depend on the accelerating radio-frequency voltage. The circulating beams induce currents in the vacuum chamber walls and these wall currents create fields which interact directly with the beam. They can alter the normal betatron and synchrotron frequencies of the beam and thus cause instabilities.
- The accelerated bunches are larger than expected. (This affects the long-term beam stability.) Bunch lengthening is again due to the short-range fields induced by the bunch in the wall. It leads to a wider energy spread within the bunch and can lead to head-tail instabilities.

There was a lot of concern at Rome that there was inadequate knowledge of beam dynamics at high energies. But a lot of experience is accumulating about high energy electron-positron machines and there was a widespread hope that while machine physicists have encountered very tricky problems indeed, they are unlikely to lead to profound revisions in the approach to LEP.

Since ECFA's Rome meeting, PETRA has run continuously and machine physicists have now pushed the beam current to a maximum of 18mA per bunch, almost up to the 20mA limitation design value. The previous current limitations have been overcome by changing the injection optics to the type also proposed for LEP. The present aim is for fast injection and a high beam intensity, and only later will PETRA go for higher energy, and hopefully, higher luminosity. The latest machine runs at a centre-of-mass energy of 16 GeV have yielded 1-2 hadronic events per nanobarn cross-section per day—which can be compared with 20-100 events at DORIS. This is not a very high luminosity; but the DESY machine physicists are confident about increasing it. Higher energies have to wait till next year when additional accelerating cavities will be switched in. □

Keeping down the cost of LEP

HIGH-ENERGY physicists have become very aware of current financial constraints, and are paying a great deal of attention to reducing the cost of LEP, without diminishing its physics potential. CERN has estimated the construction cost of a 70 GeV LEP to be a little over 1,000 MSF, which is almost the same as the SPS proton accelerator built at CERN a few years ago. No decision about the project has been taken, but ECFA hopes to present a detailed design study to the CERN Council by the end of 1979.

The physics interest in LEP is focussed on the maximum energy of the machine. Lepton physics at high energies centres around the role of the intermediate vector bosons, the charged W^+ or W^- and the neutral Z°.

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